

Distributed Transmission — FCC Enabling Rules

**A Presentation for
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Agenda

- ✓ Distributed Transmission (DTx) Systems
- ✓ Benefits of Distributed Transmission
- ✓ Background of Distributed Transmission
- ✓ Broadcaster Support
- ✓ Prerequisites for DTx Operation
- ✓ System Examples
- ✓ Enabling FCC Rules
- ✓ Conclusions

Distributed Transmission Systems

- ✓ Multiple Transmitters Covering an Area (SFN)
 - ✓ On-Channel Repeaters (successor to "Boosters")
 - ✓ Distributed Transmission
- ✓ Variety of Purposes
 - ✓ Gap Fillers (Filling in Shadows)
 - ✓ Service Maximization (Extending Service)
 - ✓ Creating Stronger Signals (Indoor Reception)
 - ✓ Transmitter Diversity (Helps Indoor Reception & New Techniques)

Benefits of Distributed Xmsn

- ✓ **Spectrum Efficiency**
 - ✓ Like Translators, But Without Another Channel
- ✓ **Stronger Signals, Less Interference**
 - ✓ Shorter Distances Need Less Fade Margin
 - ✓ Greatest Power Needed for "Last Mile"
 - ✓ Shorter Interference Zones
 - ✓ More Uniform Signal Levels

Benefits of Distributed Xmsn (2)

- ✓ Tests Show More Signal Power Is Needed
 - ✓ NAB / MSTV
 - ✓ Especially for Set Top Reception
- ✓ Transmitter Diversity
 - ✓ Fills Holes in Difficult Propagation Channels
 - ✓ Helps Set Top Reception
 - ✓ Helps Pedestrian & Mobile Reception
- ✓ But, More Difficult for Receiver Equalizers
 - ✓ Similar to Difficult Reception Locations Using Single Xmtrs
 - ✓ DTx Offers Possibility to Overcome Many Such Difficulties

Background of Distributed Transmission

- ✓ Introduced in FCC Advisory Committee in 1991
 - ✓ Commission Then Sought Input
 - ✓ Never Acted
- ✓ Other Systems Adopted SFN Techniques
 - ✓ DVB-T (Europe)
 - ✓ ISDB-T (Japan)
 - ✓ Used Lack of SFN to Sell Their Systems Against ATSC System
 - ✓ In Brazil, for example
 - ✓ ATSC had no SFN methods

Background of Distributed Transmission (2)

- ✓ DTx Introduced to ATSC VSB Enhancement Process in 2000
- ✓ DTx Recommended by FCC Spectrum Policy TF – Nov., 2002
- ✓ ATSC Standard Adopted – July, 2004
 - ✓ Defines Synchronization of Transmitters (A/110)
- ✓ ATSC Recommended Practice Adopted – September, 2004
 - ✓ Explains Design of Multiple Transmitter Networks (A/111)
- ✓ FCC Adopted DTx “In Principal” in 2nd DTV Periodic Review
 - ✓ Promised “Fast Track” NPRM – September, 2004
- ✓ ATSC Forum Now Using DTx As Argument In Its Favor

Broadcaster Support

✓ NAB President Eddie Fritts — March 30, 2004

✓ "We need to provide services that exploit all the advantages of over-the-air transmission-and reach the greatest audience possible with a reliable, received signal. For example, ATSC's work on a standard for distributed transmission is commendable. The idea of synchronized multiple transmitters has the potential to help increase the reliability of over-the-air broadcast service."

✓ Speech at ATSC Annual Meeting

Broadcaster Support (2)

✓ "The undersigned 32 organizations ... jointly urge the Commission to authorize quickly use of Distributed Transmission techniques in Digital Television (DTV) broadcast operations."

✓ Letter to FCC from 32 Organizations — June 4, 2004

✓ NAB

✓ Entravision

✓ Media General

✓ Reading

✓ Tribune

✓ Cox

✓ Allbritton

✓ Winston

✓ Liberty

✓ Emmis

✓ Meredith

✓ Southern Oregon

✓ Paxson

✓ Penn State

✓ Clear Channel

✓ Longmont Chnl 25

✓ Pappas

✓ Sinclair

✓ Bahakel

Axcera

✓ WB Network

✓ Pegasus

✓ Cascade

Harris

✓ LIN

✓ Morgan Murphy

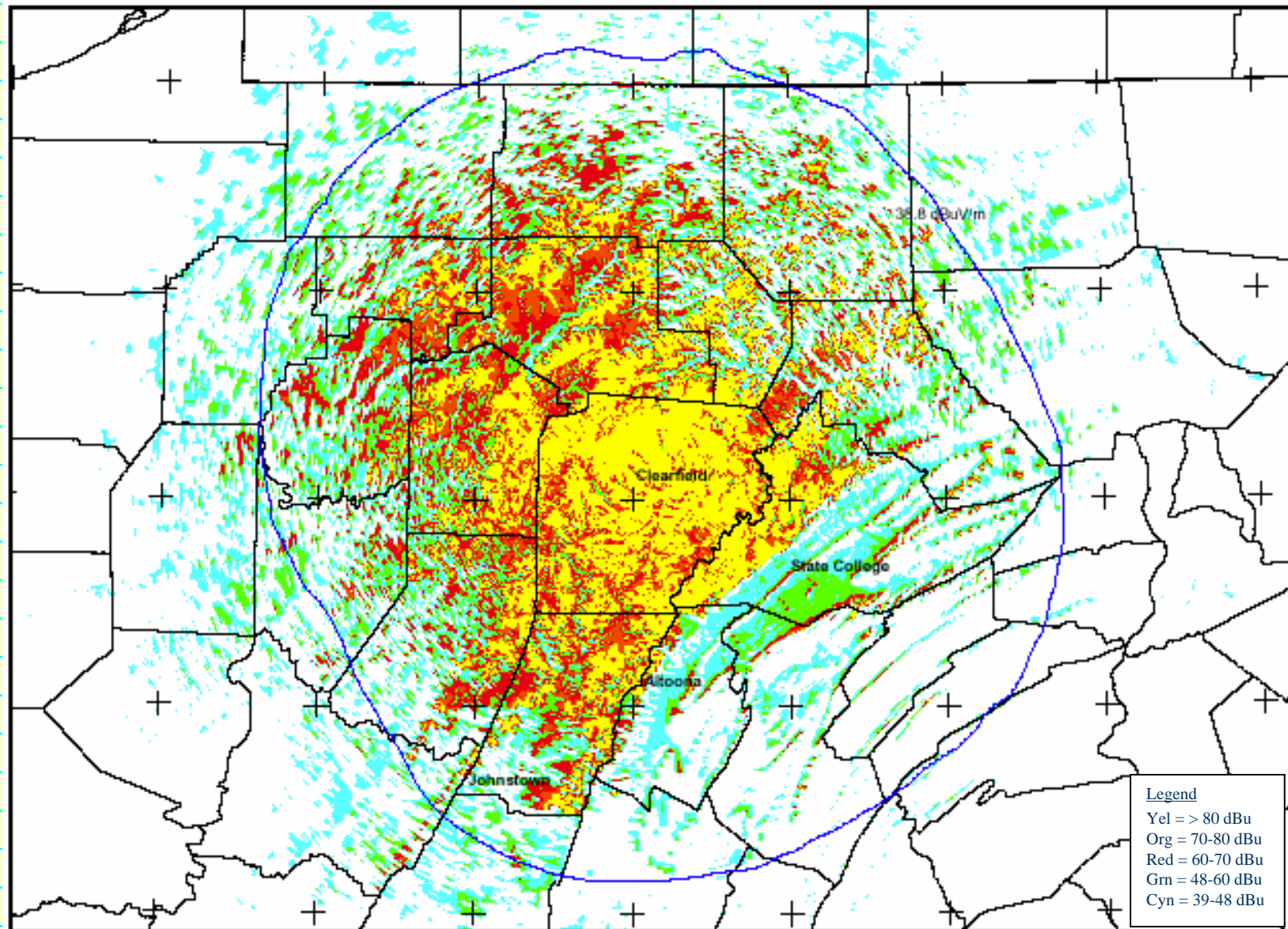
✓ Holston Valley

Thales

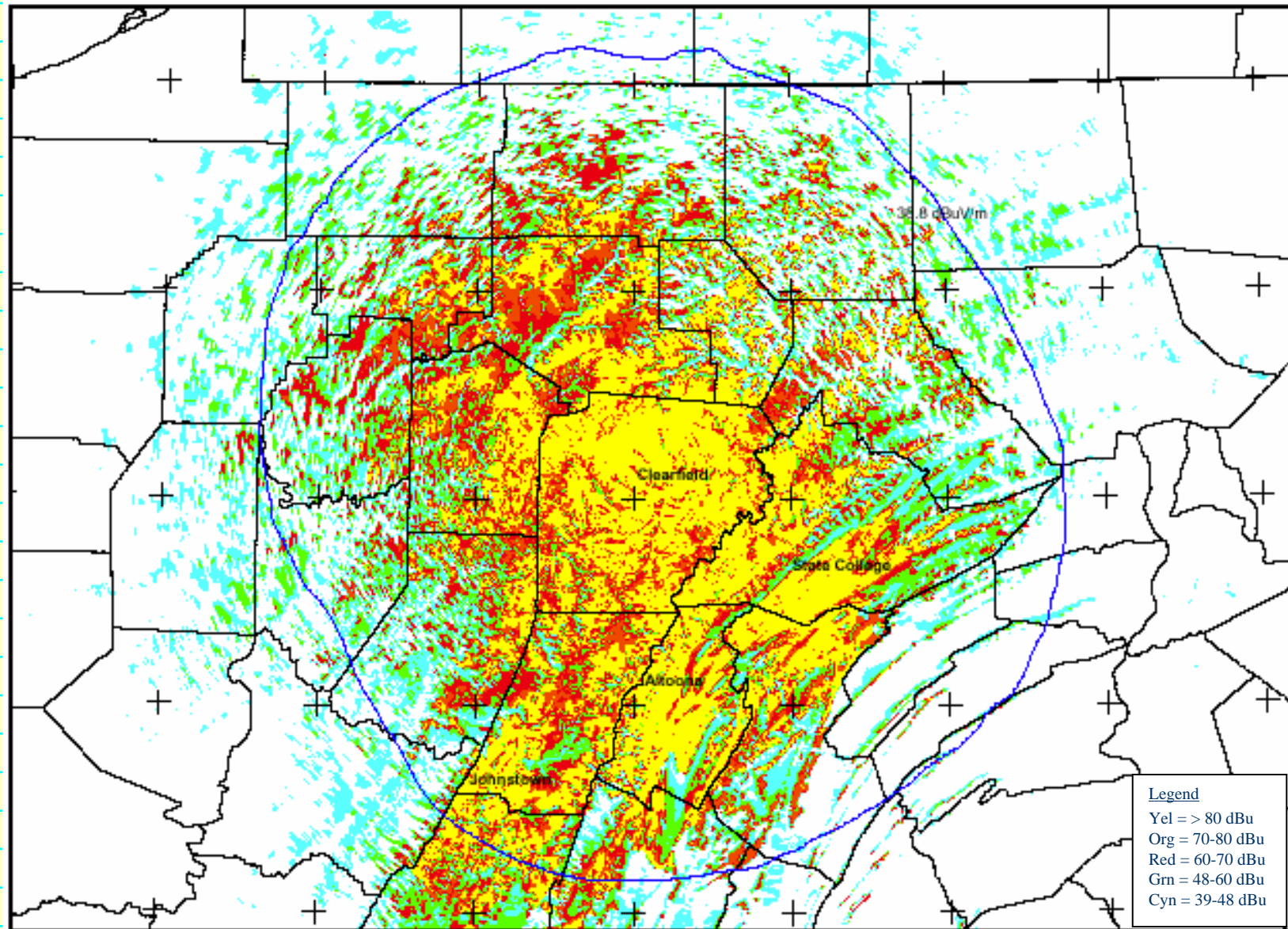
Prerequisites for DTx Operation

- ✓ **Transmitter Outputs Must Be Synchronized**
 - ✓ Same Emitted Symbols for Same Data Input
 - ✓ Precise Frequency Control of Transmitters
 - ✓ Allows Treating Alternate Signals as Echoes
 - ✓ Allows Controlled Network Output Timing
- ✓ **Capable Receiver Adaptive Equalizers**
 - ✓ Must Treat Alternate Signals as "Echoes"
 - ✓ Must Handle Strong Leading Echoes
 - ✓ Wide Equalization Range (Pre- & Post-Cursor)

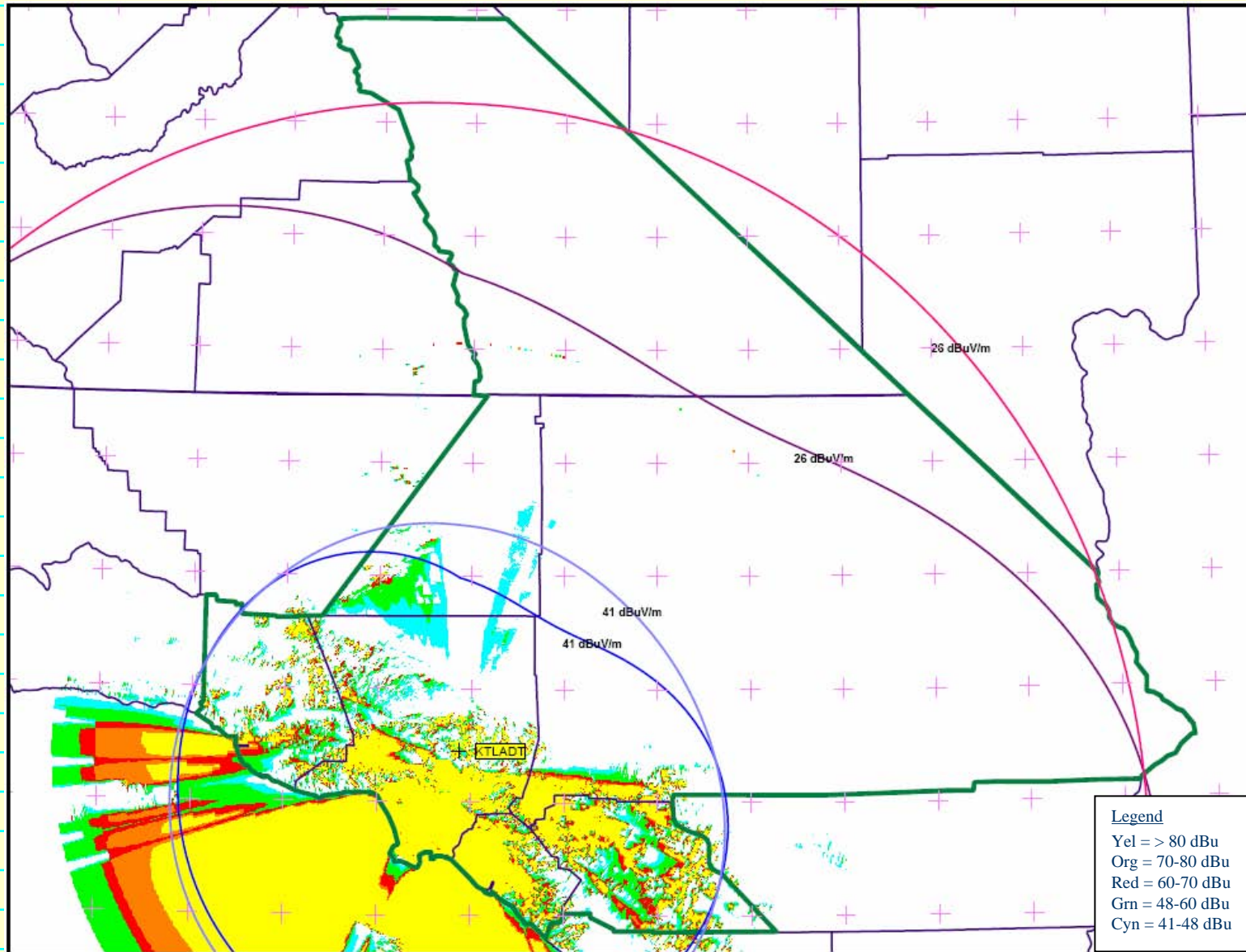
Example: Terrain-Obstructed w/Single Xmtr



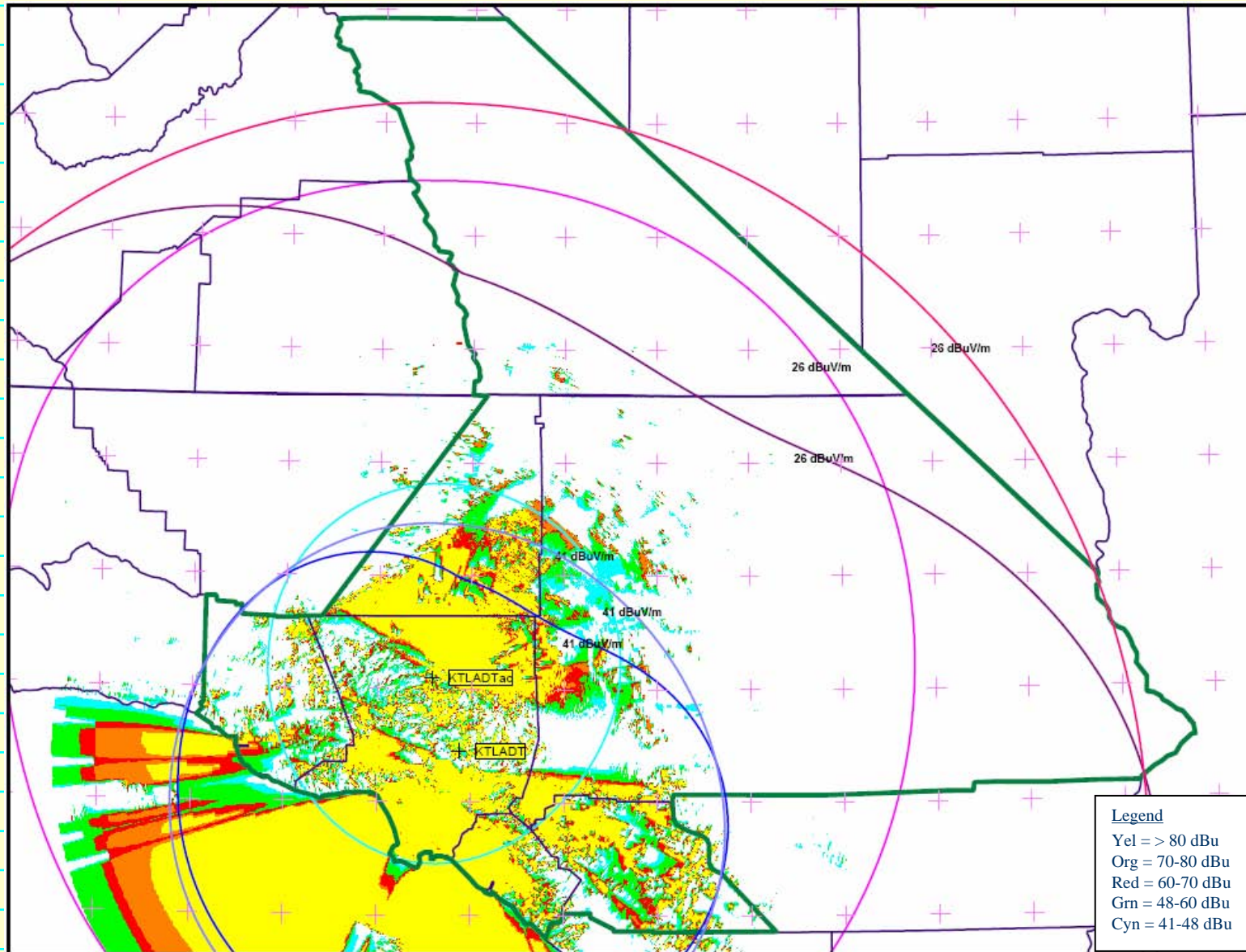
Example: Distributed Transmitters Added



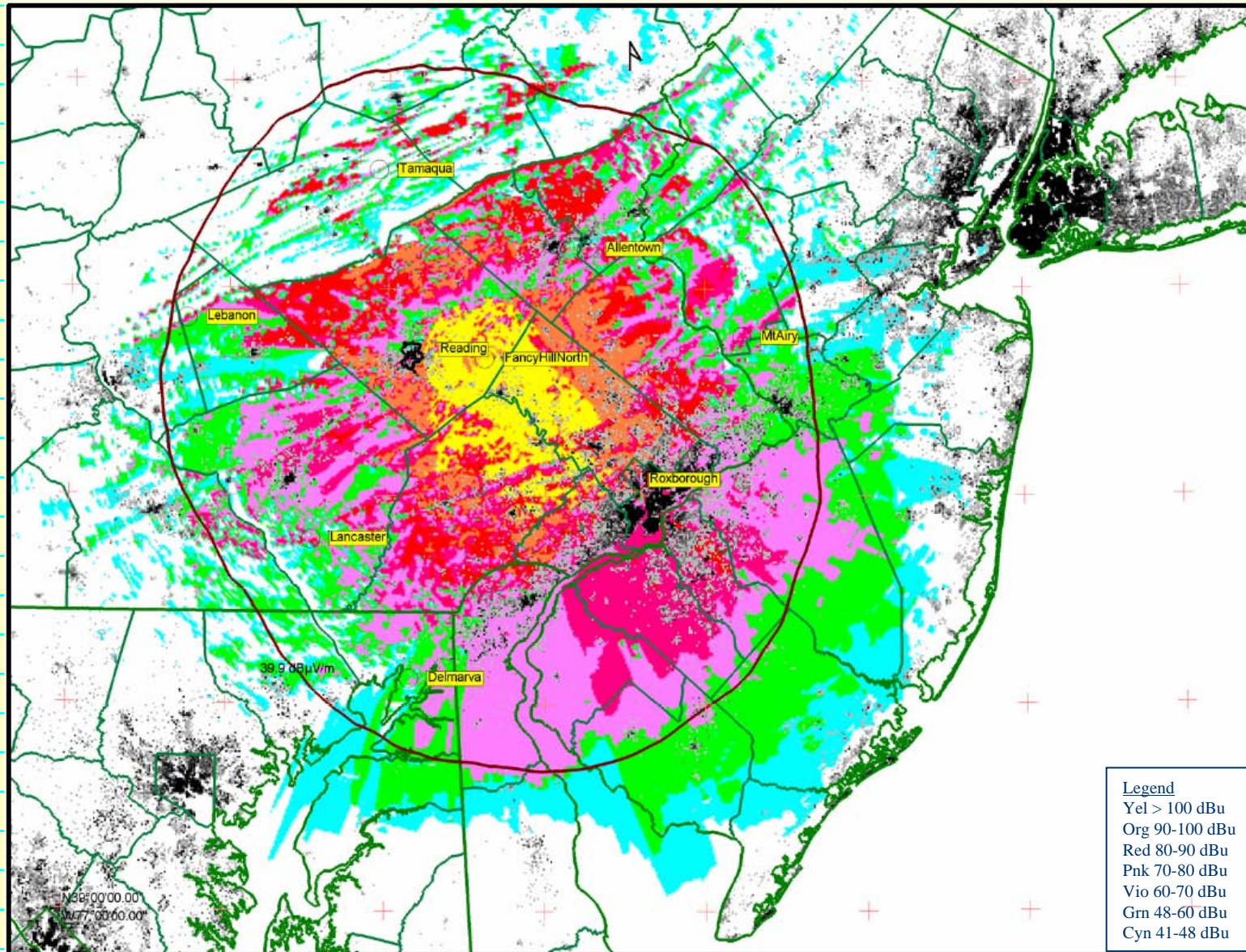
Example: Los Angeles High Desert Unserved



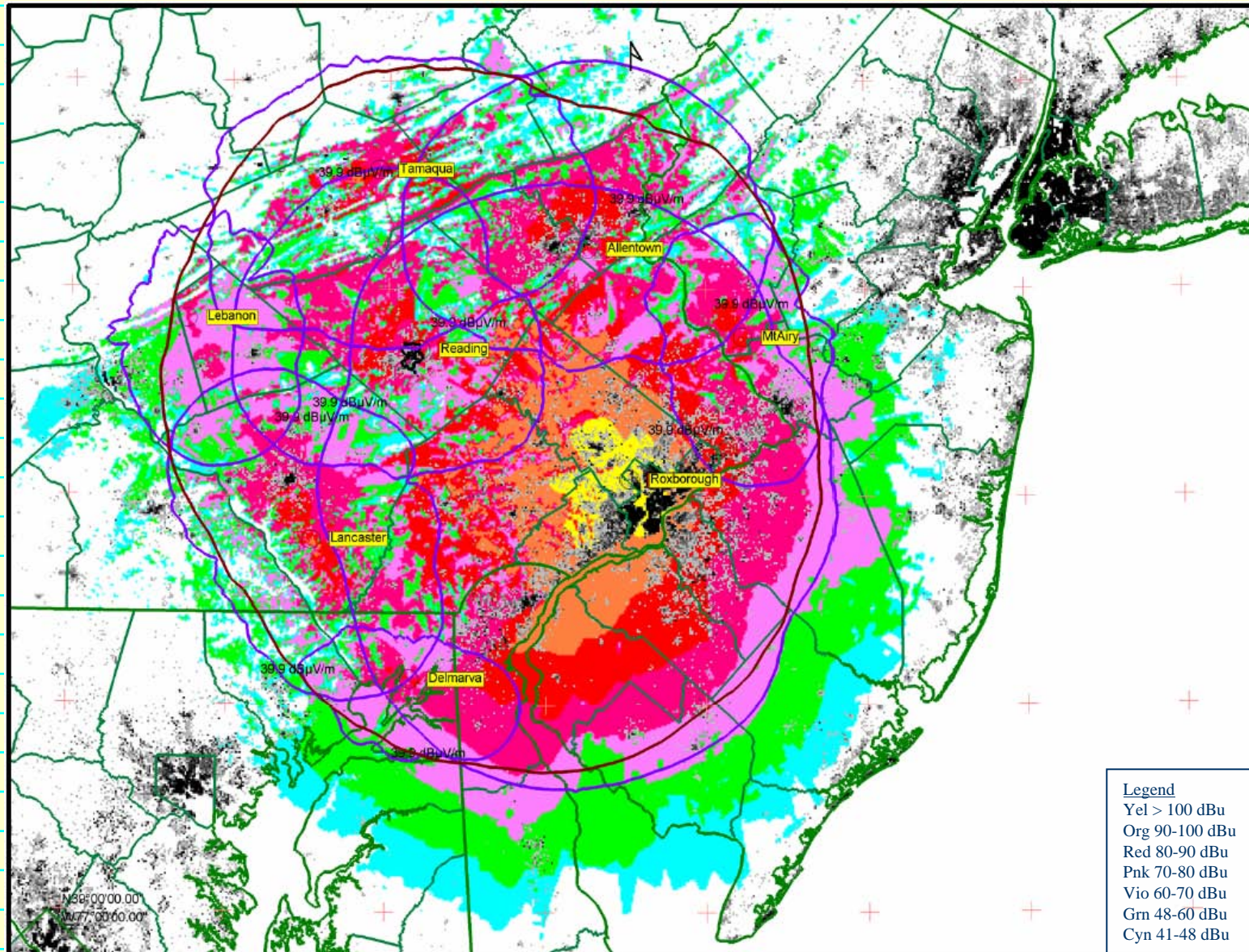
Example: Los Angeles w/High Desert Service



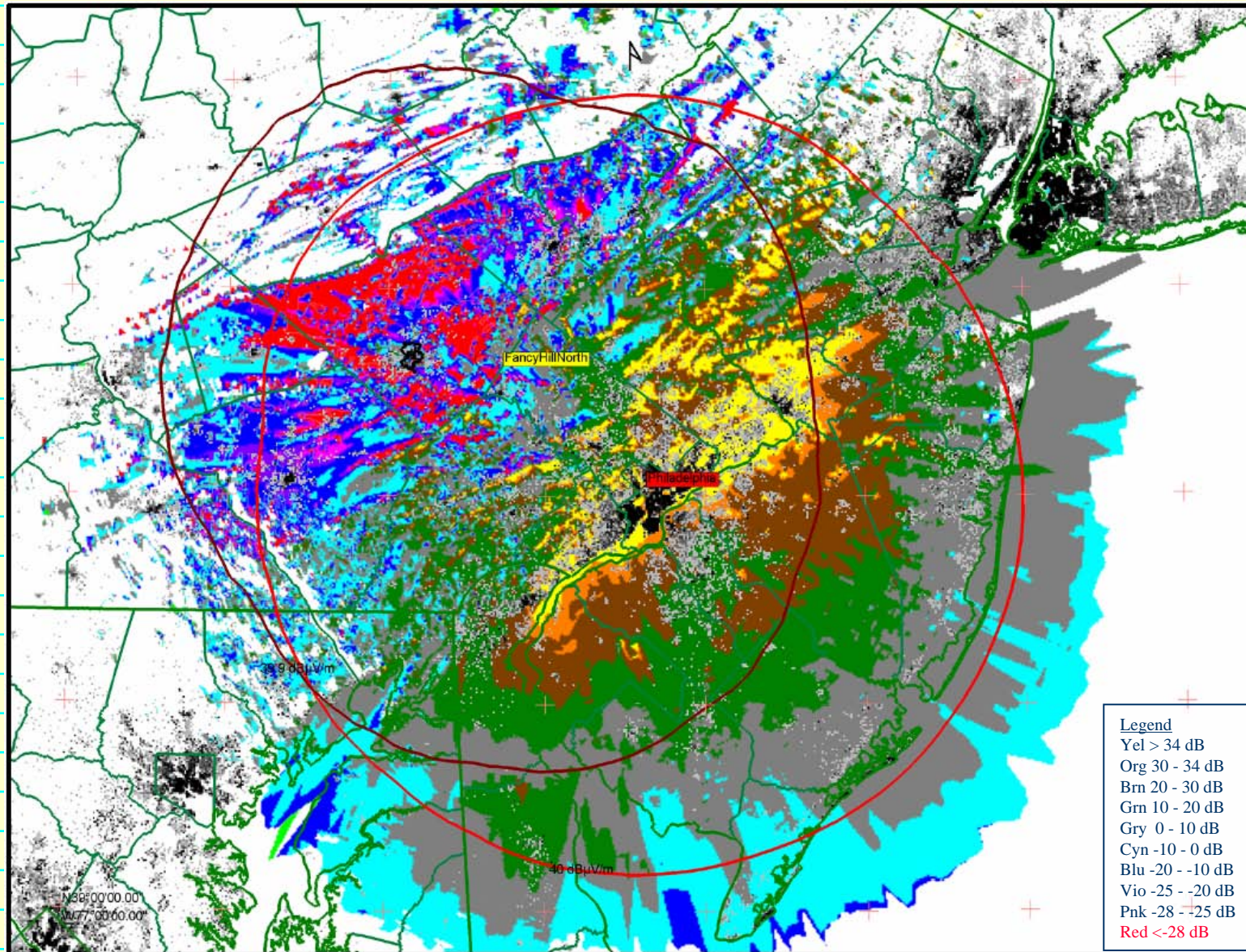
Example: Philadelphia Single High-Power Tx



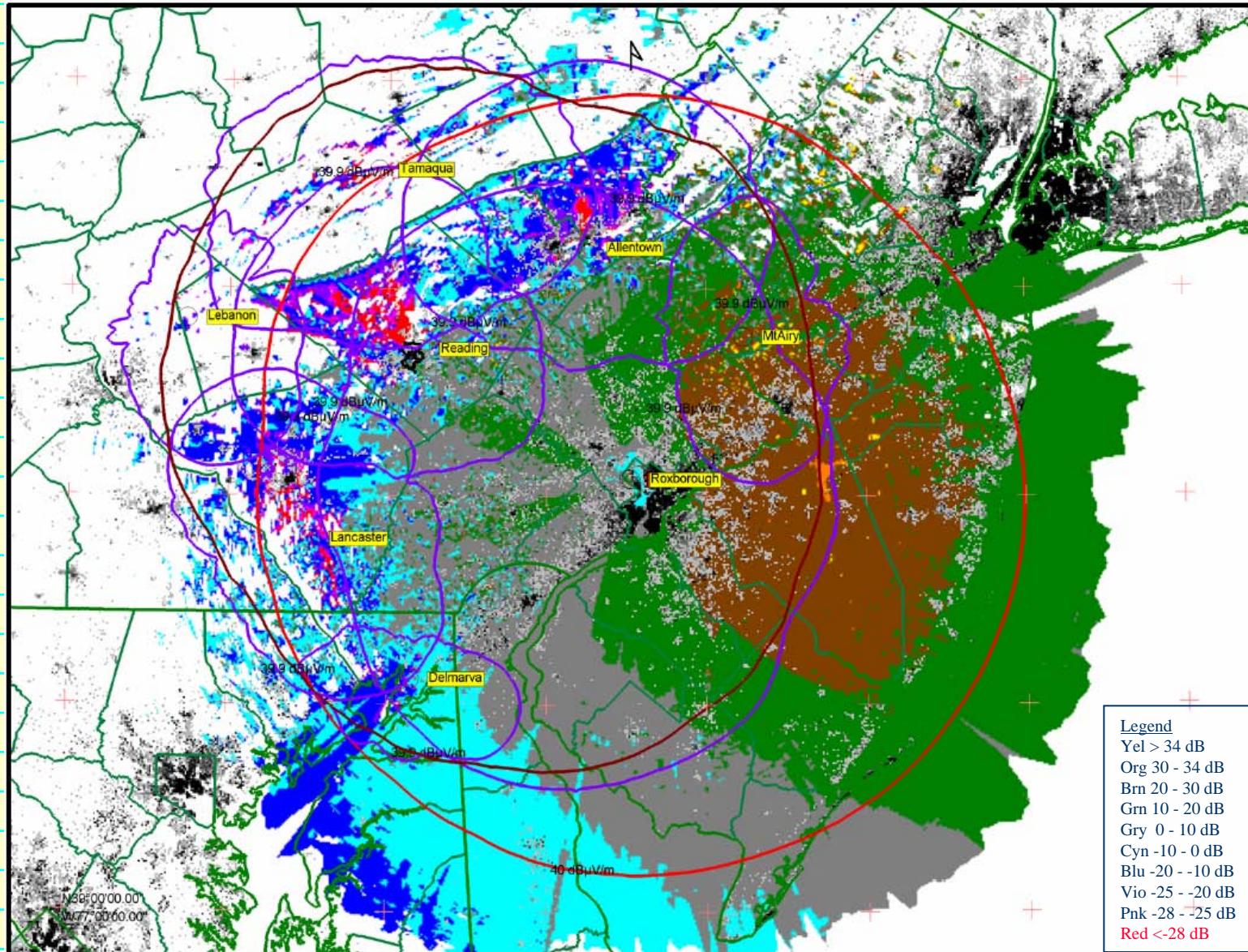
Example: Philadelphia Multiple Low-Pwr Tx



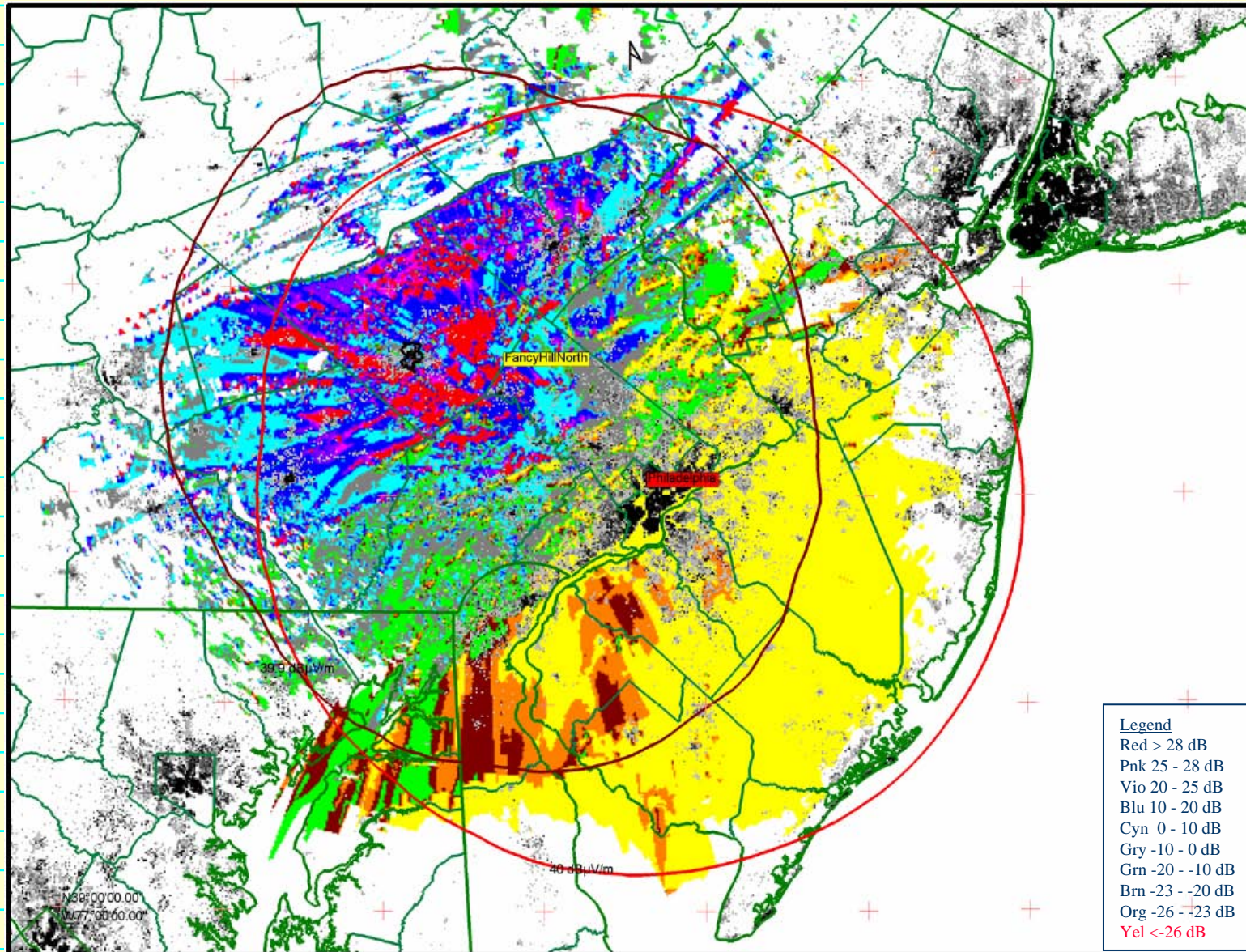
Example: Philadelphia IX to Adjacent Chnl



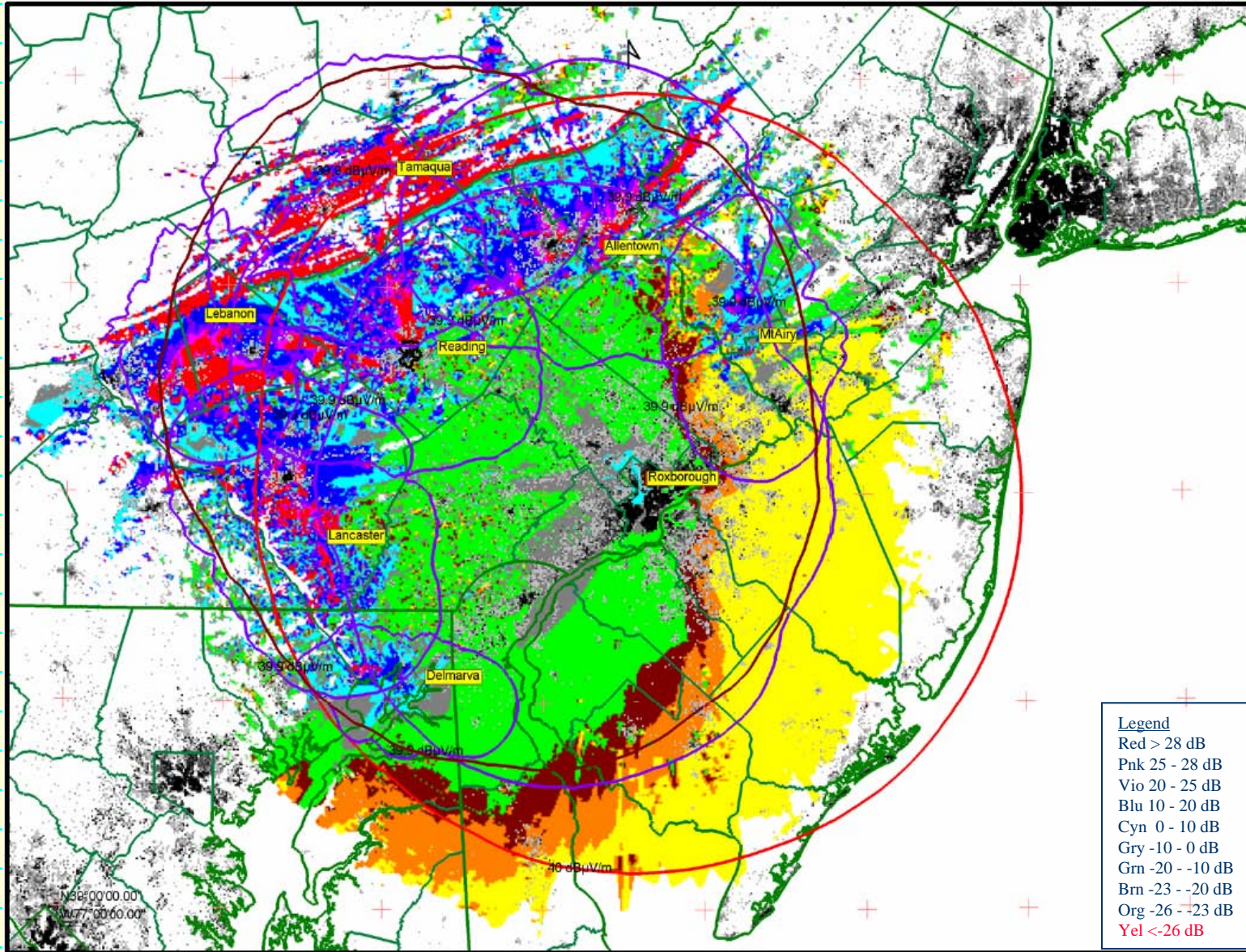
Example: Philadelphia DTx IX to Adj Chnl



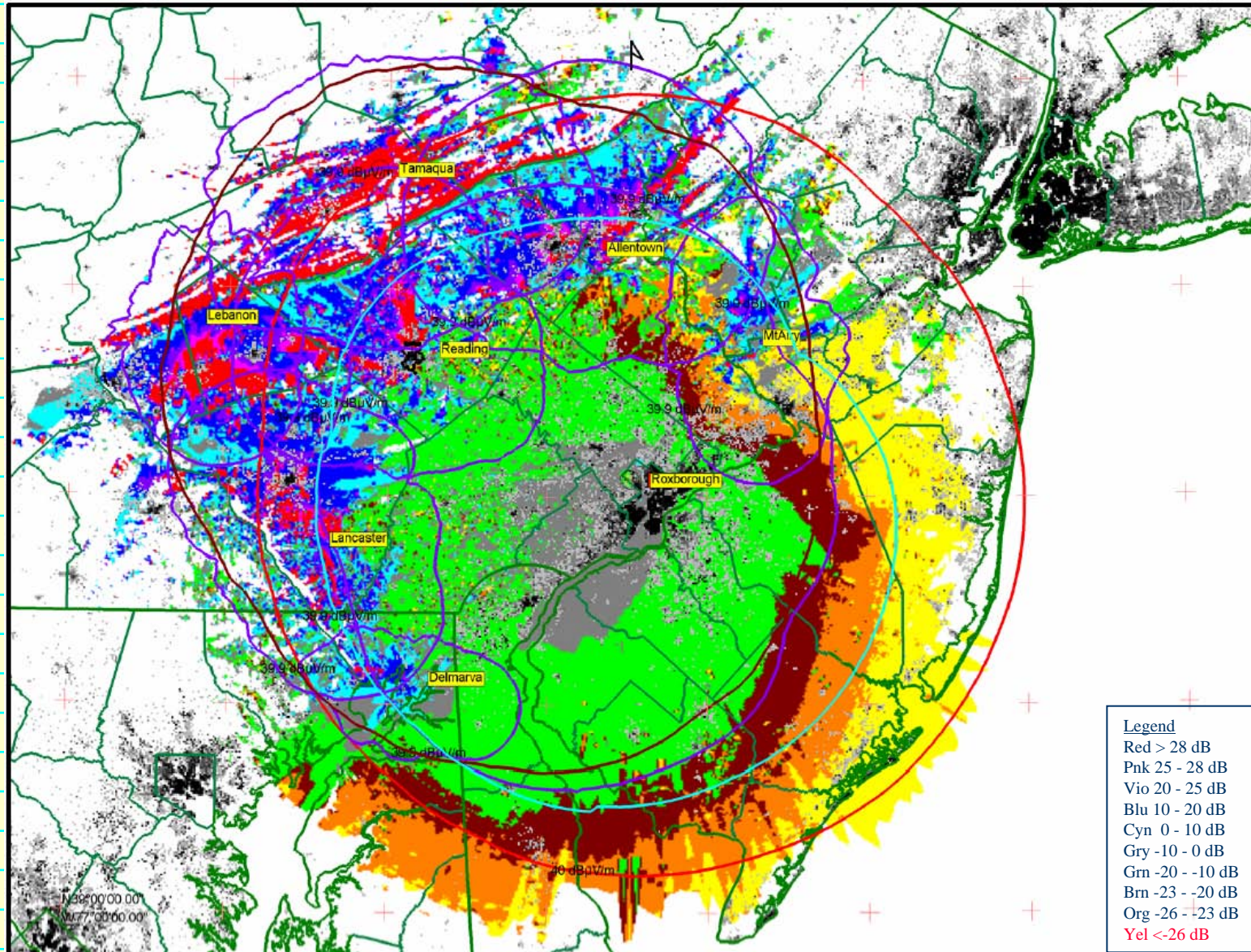
Example: Philadelphia IX from Adj Chnl



Example: Philadelphia DTx IX from Adj Chnl



Example: Philadelphia DTx Improved IX



FCC Interests in Setting DTx Rules

- ✓ FCC Interest in Maximizing Spectrum Efficiency (SPTF)
- ✓ Allowing Stations to Expand Service Areas
 - ✓ Maximizing Spectrum Efficiency by Delivering Greatest Service
 - ✓ Simultaneously Minimizing Additional Interference
- ✓ Permitting Broadcasters to Compete with Cable
 - ✓ Requires Set Top Reception, Hence Strong Signals
 - ✓ Requires Signals Delivered Wherever Carried on Cable
 - ✓ Service Limited by Smallest Aggregated Footprint of Stations
 - ✓ Current Rules Require Must-Carry Throughout DMA

FCC Interests in Setting DTx Rules (2)

- ✓ **Market Sizes Vary Across the Country**
 - ✓ **Generally Smaller in the East**
 - ✓ **Generally Larger in the West**
- ✓ **Broadcasters Concerned About Adjacent Market Encroachment**
 - ✓ **Could Occur with Large Service Area & Small DMA**
- ✓ **Optimum Balance is Maximum Service within Station's Market**
 - ✓ **Permit Maximization with Minimal Constraints**
 - ✓ **Limited by Market Boundaries (DMA)**
 - ✓ **Limited by Interference to Other Stations**

Required / Proposed Rule Changes

- ✓ **Primary Treatment of Distributed Transmitters**
 - ✓ Inclusion in Part 73 vs Part 74 in most instances
 - ✓ No Additional Spectrum Allotment Required
 - ✓ Protect Distributed Xmtr Service Area Same as Main Service
 - ✓ When Distributed Xmtrs Provide Part of Main Service
 - ✓ Filling Gaps in Coverage, Creating Hot Spots
 - ✓ Maximizing Service Area and Population
- ✓ **Permit DTV Coverage Area Extensions**
 - ✓ More Effective Service Maximization
 - ✓ Proposal for 50% Extension In Each Direction
 - ✓ Distributed Xmtrs Located Within Reference Contours
 - ✓ Population Increase Limited Outside Licensee's DMA

Required / Proposed Rule Changes (2)

✓ Limits for Main Stations Apply to Distributed Xmtrs

- ✓ Power

- ✓ Antenna Height

- ✓ *de minimis* Interference Analysis Serves as Constraint

 - ✓ Same As Single-Tx Facilities After Freeze Is Lifted

✓ Locations of Distributed Transmitters

- ✓ Within Hypothetical Maximized Service Contour

- ✓ Within Designated Market Area (DMA)

- ✓ Whichever Extends Farther in Any Given Direction

Required / Proposed Rule Changes (3)

- ✓ Service Areas Permitted
 - ✓ Always Limited by *de minimis* Rules
 - ✓ Four Choices Provided in Filed Comments
 - ✓ Limitations of Service Contours
 - ✓ Maintain Interference Contours Within Hypothetical IX Contour
- ✓ Avoiding Encroachment Into Neighboring DMAs
- ✓ More Than ½ of Population Served Must Be Within DMA
 - ✓ Evaluated for Each Distributed Transmitter
 - ✓ When Extending Outside Hypothetical Maximized Service Contour

Required / Proposed Rule Changes (4)

- ✓ **Eliminate Constraints of Analog Service Rules**
 - ✓ **Analog Booster Rules Required Contours within Contours**
 - ✓ **Before Modern IX Analysis Methods Were Available**
- ✓ **Interference Analysis Methods Extended**
 - ✓ **Modifications to Current Techniques / Software**
 - ✓ **Addition of 1 Field to FCC Database Records**
 - ✓ **FCC Software Supplier Involved in Developing These Extensions**